



## Original communication

## Analysis of fatal road traffic accidents in a coastal township of South India

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## ABSTRACT

Road traffic accidents (RTAs) are important causes of mortality and morbidity due to the increasing number of vehicles, changes in lifestyle and the risk behaviours among general population. With the aim of exploring various epidemiological characteristics of RTAs, this retrospective analysis of medico-legal autopsies was conducted between January 2005 and December 2009 in the Department of Forensic Medicine, Kasturba Medical College, Manipal in Karnataka, South India. The information was collected from post-mortem registers and inquest documents received from the investigating police officers. The collected information was analysed using SPSS version 11.0. Out of the 879 autopsies conducted during the study period, 39% were due to RTAs. Among the victims, 89.8% were males and 10.2% were females. The mean age of victims was 38.7 years, which was slightly higher in females compared to males. Most of the male victims belonged to the age group 20–29 years. The head injuries were responsible for nearly 3/4th of deaths followed by abdominal injuries (6.7%). The mean duration of survival following road traffic accident was 6–7 days. Occupants of motorized two wheelers (43%) and pedestrians (33%) were the most common victims of RTAs followed by occupants of light motor vehicles (LMVs). The most common offending agents in road traffic accidents were heavy motor vehicles (35.2%) followed by light motor vehicles (31.7%). In view of the above finding, it is apt to conclude that RTAs are important public health hazards and should be addressed through strengthening of emergency healthcare, stricter enforcement of traffic laws and health education.

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## 1. Introduction

Road traffic accidents are increasingly becoming events of public health importance mainly owing to their increased frequency of occurrence and also to the ever increasing numbers of vehicles around the world. According to Global Status Report on Road Safety-2009, over 1.2 million people die each year on the world's roads, and between 20 and 50 million suffer non-fatal injuries. Nearly 97% of the road traffic accidents around the globe occur in low and middle income countries, which have only 48% of the registered vehicles.<sup>1</sup> India being a developing country is experiencing a double burden from already existing communicable

diseases and increasing burden of non-communicable diseases including road traffic accidents. Currently, the road traffic accidents are placed at 9th position among the 100 important causes of death. However, future predictions suggest that road traffic accidents will move up to sixth place as a cause of death and in terms of years of life lost (YLL) and 'disability-adjusted life years' (DALYs) will be in second and third place respectively by the year 2020.<sup>2</sup> It is well known that enormous growth in the number of motor vehicles, increase in population and poor infrastructure in the form of inadequate access to healthcare and bad roads are some of the important factors in deaths due to road traffic accidents. Hence, analysis of the various aspects of epidemiology of road traffic accidents through detailed research becomes essential. A detailed trend analysis of age and gender based variations in the pattern of road traffic fatalities in the region has been reported.<sup>3</sup> The present research presents the detailed analysis of fatal road traffic accidents in the region and provides insights on the cause of death of victims in road traffic accidents, period of survival, status of victims,

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offending vehicles and circumstances in fatal road traffic accidents along with age and sex distribution of the victims in fatal road traffic accidents during the study period.

## 2. Materials and methods

The present research is a retrospective analysis of medico-legal autopsies conducted during January 2005 and December 2009 at the Department of Forensic Medicine, Kasturba Medical College (KMC), Manipal. KMC is situated in Udupi district of coastal Karnataka, in South India. Medico-legal autopsies in India are carried out on requisition by the police or the magistrate with a primary aim to reveal the cause of death and to decide if the cause of death is in accordance with the postulated manner of death. All the medico-legal autopsies are recorded in post-mortem register. Recorded details include name, age, sex, address, information, furnished by the police in the inquest papers, autopsy findings, investigations, if any, and cause of death. All the fatal road traffic accidents were included in the study and the autopsy files and inquest documents provided by the investigating officer were studied in detail. The information obtained from the autopsy case files and information furnished by the police was registered in a database and analysed using the statistical software (SPSS version 11.0).

## 3. Results

A total of 879 medico-legal autopsies were conducted during the study period (2005–2009). Road traffic fatalities alone accounted for 39.1% ( $n = 344$ ) of the total autopsied cases. Detailed distribution of road traffic fatalities during the study period is shown in Table 1. 89.2% victims were males ( $n = 307$ ) and 10.8% females ( $n = 37$ ), male-female ratio in road traffic fatalities being 8.3: 1. Age of the victims ranged from 1 to 83 years, mean age being  $38.7 \pm 16.9$  years. Mean age of victims was higher in females ( $40.7 \pm 21.9$  years) than males ( $38.5 \pm 16.2$  years). The age difference was however, not statistically significant ( $p = 0.450$ ). On analysing the trend of cases in each decade of life, it was observed that most of the victims were in the 3rd decade of life (28.5%,  $n = 98$ ). Maximum number of males ( $n = 94$ , 30.6%) were aged between 20 and 29 years. While the male fatality pattern varied during the different age groups, the distribution of female cases was fairly uniform throughout each decade of life (Fig. 1).

Head injury alone remained the most common cause of death, that was responsible for 3/4th of road traffic fatalities ( $n = 258$ ) followed by abdominal injuries and injuries to the limbs that were responsible for 6.7% and 5.2% fatalities respectively. Distribution of fatal injuries in road traffic accidents is shown in Fig. 2. Mean survival period in road traffic fatalities was 6–7 days. Distribution of road traffic fatalities based on the period of survival prior to the fatal outcome is shown in Table 2.

Occupants of motorized two wheelers ( $n = 148$ , 43%) and pedestrians ( $n = 114$ , 33.1%) were the most common victims of fatal

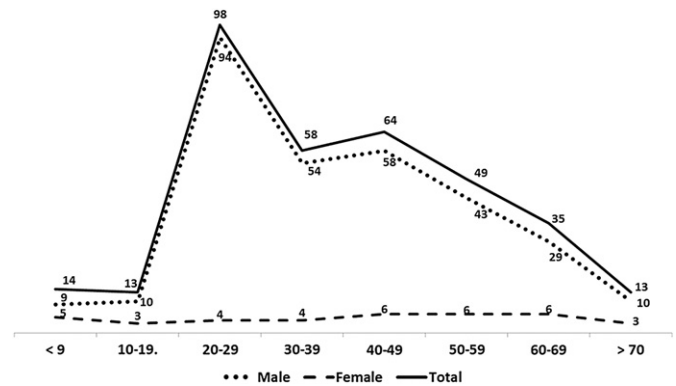
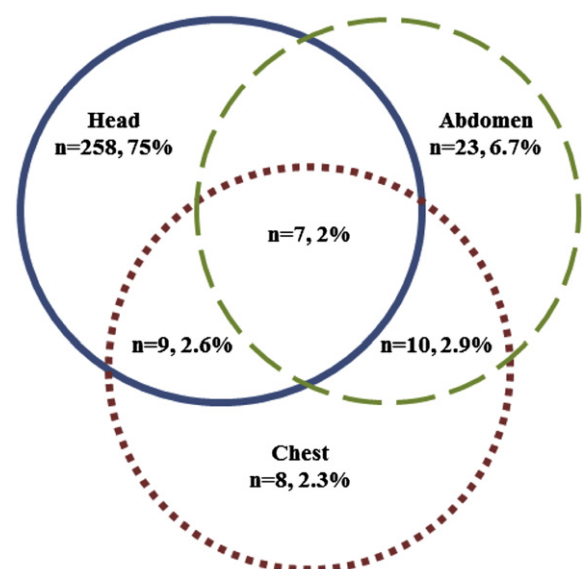


Fig. 1. Age-wise distribution of the victims of road traffic fatalities.

road traffic accidents followed by occupants of light motor vehicles (LMVs), heavy motor vehicles (HMVs) and pedal cyclists. In the 'Others' category, one victim sustained fatal injuries while boarding the bus, one met with an accident while playing near the house, while another one was a passenger on a bullock cart. The victim details are shown in Table 3. The LMVs included autos, cars, vans and jeeps, while the HMVs included buses, trucks, lorries, tractors and tankers. The most common offending agents in road traffic accidents were heavy motor vehicles ( $n = 121$ , 35.2%) followed by light motor vehicles ( $n = 102$ , 31.7%) and two wheelers ( $n = 53$ , 15.4%). In 16 cases (4.7%), the offending vehicles could not be identified and remained unknown indicating the incidence of 'hit and run' cases. Details of the offending vehicles/circumstances of fatal road traffic accidents are shown in Table 3.

## 4. Discussion

Medico-legal autopsies are performed as per the laws of the land towards administration of justice. In India, medico-legal autopsies are conducted in cases when the death is sudden, unexpected, suspicious or unnatural with a primary aim to reveal



Spinal injury=02 (0.6%), Injuries to the limbs=18 (5.2%), Multiple injuries=08 (2.3%), None=01 (0.3%)

Fig. 2. Distribution of fatal injuries in road traffic fatalities.

Table 1

Frequency of Road traffic fatalities (RTF) in relation to the total medico-legal autopsies (TMLA) during the study period.

Year	Total medico-legal autopsies (TMLA)	Road traffic fatalities (RTF)	RTF/TMLA (%)
2005	141	47	33.4
2006	155	52	33.5
2007	151	63	41.7
2008	196	81	41.3
2009	236	101	42.8
Total	879	344	39.1

**Table 2**  
Distribution of road traffic fatalities based on the period of survival.

Survival	n	%
<3 h	84	24.4
3–6 h	34	9.9
6–12 h	37	10.8
12–24 h	34	9.9
1–3 days	57	16.6
3–7 days	28	8.1
7–30 days	51	14.8
>30 days	19	5.5
Total	344	100.0

the cause of death and to decide if the cause of death is in accordance with the postulated manner of death. 'Unnatural death' means death of a person caused by suicide or by another, or by an animal or by machinery or a motor vehicle or by an accident, or under circumstances raising a reasonable suspicion that some person has committed an offence or foul play.<sup>4</sup> In India, manner of death in all cases of fatal unintentional injuries is designated as accidental. Hence, fatal road traffic accidents constitute the fatal outcome of unintentional injuries sustained in road traffic crashes.

During the study period, road traffic accidents alone accounted for 39% of the total medico-legal autopsies conducted in the study centre. The proportion of road traffic accidents showed a consistent increase over the duration of five years study period (Table 1). Road traffic fatalities are the most common cause of fatalities from unnatural causes in the region<sup>5</sup> that has shown an increasing trend during the last five years.<sup>3</sup> Our observations are consistent with other studies.<sup>6–8</sup> The increasing trend of road traffic fatalities can be attributable to the tremendous increase in number of motor vehicles, poor state of the roads, rash and negligent driving on the roads and negligent use of safety measures. The increasing trend is of specific concern since the increasing road traffic accidents are a major public health hazards, particularly so in developing countries like India where healthcare infrastructure in the form of emergency care is far from satisfactory. According to National Crime Records Bureau (NCRB), the road traffic accidents were responsible for more than 2/3rds of all unnatural accidental deaths in India. The casualties in relation to road traffic accidents have increased by 5.5% during the year 2010 compared to 2009.<sup>9</sup>

The majorities of the road traffic accident victims in our study were males and belonged to young and middle age groups. 3rd decade alone constituted for 28.5% of the total road traffic fatalities during the study period. Age and gender based variations in the pattern of road traffic fatalities in the region has been reported and extensively discussed by Kanchan et al.<sup>3</sup> Our observations from the region are a cause of serious concern as the people in this age group

**Table 3**  
Details of the victims and circumstances/offending vehicles in fatal road traffic accidents.<sup>a</sup>

Victim	Circumstances of traffic accidents/ Offending vehicle
Pedestrian (n = 114, 33.1%)	Heavy motor vehicle (n = 121, 35.2%)
Pedal cyclist (n = 15, 4.4%)	Light motor vehicle (n = 102, 31.7%)
Vehicular passengers:	Two wheeler (n = 53, 15.4%)
- Two wheeler (n = 148, 43.0%)	Unknown (n = 16, 4.7%)
- Light motor vehicle (n = 43, 12.5%)	Others:
- Heavy motor vehicle (n = 21, 6.1%)	- Skid/fall/toppled/overturned (n = 39, 11.3%)
- Others (n = 3, 0.9%)	- Hit against tree/wall/pole/standing lorry (n = 13, 3.8%)

<sup>a</sup> This being a retrospective study, exact cause and responsibility of road traffic incident was not established at the time of autopsy. The information is based on history and preliminary police investigations.

not only constitute of the major working class of our society and nation at large, but also are the bread winners for their families. The death of an economically productive individual especially in younger age is a matter of great loss to the family, society and the nation.

Head injury was the most common cause of death following a road traffic accident. Nearly 3/4th of the victims in our study died of head injury and its complications. Findings of the present research are consistent with other studies.<sup>6,7,10–18</sup> Our observation highlights the need for dedicated neuro-surgical care in fast growing cities like Manipal, as head injuries are very often fatal or otherwise disabling unless immediate, high quality intervention is provided. Thoraco-abdominal injuries and injuries to the limbs were the other common causes of death in fatal road traffic accidents. Thoraco-abdominal involvement in the road traffic accidents can be related to the anatomical location of this region that makes it easily susceptible to impact in any form of blunt force trauma. Shetty et al. have reported the pattern of thoraco-abdominal injuries sustained in fatal road traffic accidents.<sup>19</sup>

In our study more than half of the victims (55%) died within 24 h of accident and approximately 1/4th of the victims (24.4%) survived for less than 3 h. The duration of survival in fatal road traffic accidents in our study was higher than that reported in other studies.<sup>7,11,13,16</sup> This difference can be attributable to the availability of a vast network of hospitals both in public and private sectors with good emergency services in and around Manipal. The recent launch of 108 emergency response services by the Karnataka government<sup>20</sup> can be a perfect adjunct for prevention of road traffic accident related morbidity and mortality even further.

With regard to offending vehicles in fatal road traffic accidents in our study, the heavy motor vehicles (35%) and light motor vehicles (31.7%) constituted of the major offenders followed by two wheelers (15.4%). Our findings may be attributed to the high speed, narrow roads, and hilly terrain of the region. Similar observations are made in the earlier studies from India.<sup>16,17,21</sup> In the present study more than 3/4th of the victims were either occupants of motorized two wheelers (43%) or pedestrians (33%). Our findings in this regard are consistent with other studies from different parts of India.<sup>7,11,15–17,21–24</sup> India has about 1% of world's vehicle population, but 6% of the world's accidents occur in India.<sup>25</sup> Two wheeler accidents have reportedly a maximum case fatality in accidents.<sup>26,27</sup> Jain et al. have reported a detailed analysis of two wheeler accidents in the region.<sup>28</sup> The analysis of risk stratification in road traffic accidents reveals that two wheeler riders were more commonly injured than the pedestrians. These findings can be correlated to the involvement of younger age group who use two wheelers as a more common mode of transport. Dandona et al have studied the Risky behaviour of drivers of motorized two wheeled vehicles in India.<sup>29</sup> A global distribution of road traffic deaths by road user groups has been extensively discussed by Naci H et al.<sup>30</sup> For effective prevention of road traffic accidents, the focus of intervention should be on vulnerable road users. The majority of road traffic victims in low- income and middle income countries are motorcyclists and pedestrians. Pedestrian injuries alone account for 41–75% of all road traffic fatalities in most studies from less developed countries.<sup>31</sup> To prevent loss of precious human lives, helmet wearing was made compulsory all over India in the recent years. However, the compliance of the same is poor. A large number of fatalities in two wheeler accidents in India can be attributed to the fact that still motor vehicle riders tend to drive without helmets out of negligence and carelessness, lack of strict law enforcement in India only couples the problem. In India, as in many other developing countries the pedestrians tend to use roads despite availability of clearly marked footpaths and subways for their convenience. This type of behaviour should be modified through

proper education and awareness generation among general population.

## 5. Conclusion

The present research shows that the road traffic accidents are on the rise and continue to be an important public health problem in the region. Head injuries are responsible for death in majority of victims along with injuries to abdomen and extremities. The health system needs to be strengthened especially for the provision of emergency care services to the accident victims and initiatives like 24 h emergency response services should be expanded and strengthened in the country. However, provision of curative services alone is not likely to address the issue of mortality and morbidity associated with road traffic accidents, unless steps are taken to protect the vulnerable road users like pedestrians and two wheeler occupants from sustaining the injuries. Health education through mass media and posters regarding adequate road safety measures, coupled with stricter enforcement of traffic laws especially in relation to compulsory helmet wearing, speed limits etc. could go a long way in curbing the epidemic of road traffic accidents.

## Conflict of interest statement

The authors have no conflict of interest to be declared.

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## Ethical approval

None.

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